

WHAT IS CLAIMED IS:

1. An isolated polynucleotide encoding an MKK1 protein.

5 2. The isolated polynucleotide of Claim 1 having the nucleotide sequence of SEQ ID NO:1.

3. An isolated polynucleotide encoding an MKK2 protein.

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4. The isolated polynucleotide of Claim 3 having the nucleotide sequence of SEQ ID NO:3.

15 5. An isolated polynucleotide encoding an MKK3 protein.

6. The isolated polynucleotide of Claim 5 having the nucleotide sequence of SEQ ID NO:5.

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7. A recombinant DNA vector containing a polynucleotide sequence that encodes an MKK1 protein.

8. A recombinant DNA vector containing a polynucleotide sequence that encodes an MKK2 protein.

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9. A recombinant DNA vector containing a nucleotide sequence that encodes an MKK3 protein.

30 10. An engineered host cell that contains the recombinant DNA vector of Claims 7, 8, or 9.

11. An antisense molecule containing a sequence complementary to at least a part of the coding sequence of an MKK1 protein which inhibits translation of the MKK1 mRNA in a cell.

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12. An antisense molecule containing a sequence complementary to at least a part of the coding sequence of an MKK2 protein which inhibits translation of the MKK2 mRNA in a cell.

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13. An antisense molecule containing a sequence complementary to at least a part of the coding sequence of an MKK2 protein which inhibits translation of the MKK2 mRNA in a cell.

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14. An isolated recombinant MKK1.

15. The isolated recombinant MKK1 of Claim 14 comprising the amino acid sequence depicted in

15 Figures 1A and 1B.

16. An isolated recombinant MKK2.

17. The isolated recombinant MKK2 of Claim 16 comprising the amino acid sequence depicted in Figures 2A and 2B.

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18. An isolated recombinant MKK3.

19. The isolated recombinant MKK3 of Claim 18 comprising the amino acid sequence depicted in Figures 3A and 3B.

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20. A fusion protein comprising MKK1 linked to a heterologous protein or peptide sequence.

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21. A fusion protein comprising MKK2 linked to a heterologous protein or peptide sequence.

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22. A fusion protein comprising MKK3 linked to a heterologous protein or peptide sequence.

23. A monoclonal antibody which binds to an
5 epitope of MKK1.

24. A monoclonal antibody which binds to an epitope of MKK2.

10 25. A monoclonal antibody which binds to an epitope of MKK3.

26. A method for producing recombinant MKK1 comprising:

15 (a) culturing a host cell transformed with the recombinant DNA expression vector of Claim 7 and which expresses MKK1; and

(b) recovering the MKK1 gene product from the cell culture.

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27. A method for producing recombinant MKK2 comprising:

(a) culturing a host cell transformed with the recombinant DNA expression vector of Claim 8 and which
25 expresses MKK2; and

(b) recovering the MKK2 gene product from the cell culture.

28. A method for producing recombinant MKK3
30 comprising:

(a) culturing a host cell transformed with the recombinant DNA expression vector of Claim 9 and which expresses MKK3; and

(b) recovering the MKK3 gene product from the
35 cell culture.

29. A method of inhibiting the effects of signal transduction by an endogenous MKK protein in a cell comprising delivering a DNA molecule encoding a signalling incompetent form of the MKK protein to the cell so that the signalling incompetent MKK protein is produced in the cell and competes with the endogenous MKK protein for access to molecules in the MKK protein signalling pathway which activate or are activated by the endogenous MKK protein.

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30. The method of claim 29 wherein the DNA molecule encoding a signalling incompetent form of the MKK protein is delivered to the cell by a viral vector.

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